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A complete listing of
**Lecture Notes in
 Computer Science**

Volumes 1-45

Edited by

G. Goos, University of Karlsruhe,
 Federal Republic of Germany

J. Hartmanis, Cornell University,
 Ithaca, New York

Volume 1

GI

Gesellschaft für
 Informatik e. V.

3. Jahrestagung

Hamburg, October 8-10, 1973

Edited by

W. Brauer, University of
 Hamburg, Federal Republic
 of Germany

(20 contributions in English)
 1973. xi, 508p. 82 illus. paper
 \$13.20

Contents

Hauptvorträge. Automaten-
 theorie. Effiziente Algorithmen.
 Syntax von Programm-
 iersprachen. Semantik von
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 Programmiersprachen und Über-
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 Rechnersysteme—Analyse und
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 Prozessrechner. Linguistische
 Untersuchungen. Methoden der
 Informatik für spezielle Anwen-
 dungen.

Volume 2

GI

Gesellschaft für
 Informatik e. V.

**1. Fachtagung über
 Automatentheorie und
 Formale Sprachen**

Bonn, July 9-12, 1973

Edited by

**K.-H. Böhring and
 K. Indermark**, University of
 Bonn, Federal Republic
 of Germany

(16 contributions in English)
 1973. vii, 322p. paper \$10.10

Contents

Hauptvorträge. Automaten-
 theorie. Formale Sprachen.
 Algorithmen- und
 Komplexitätstheorie. Theorie der
 Programmierung.

Volume 3

**5th Conference on
 Optimization
 Techniques**

Part 1

Edited by

A. Ruberti, University of Rome,
 Italy

1973. xiii, 565p. numerous illus.
 paper \$14.70

Contents

System Modelling and Identifica-
 tion. Distributed Systems. Game

Continued

Theory. Pattern Recognition. Optimal Control. Stochastic Control. Mathematical Programming. Numerical Methods.

Volume 4

5th Conference on Optimization Techniques

Part 2

Edited by
A. Ruberti, University of Rome, Italy

1973. xiii, 389p. numerous illus. paper \$10.80

Contents

Urban and Society Systems. Computer and Communication Networks. Environmental Systems. Economic Models. Biological Systems.

Volume 5

International Symposium on Theoretical Programming

Edited by
A. Ershov and
V. A. Nepomniaschy, Computer Center, Informatics Division, Novosibirsk, USSR

1974. vi, 407p. paper \$12.30

Contents

Introduction. An Axiomatic Definition of the Programming Language PASCAL. The Logic of "can do". Copying in Commutation—Operator Schemata. On Synthesizing Programs Given by Examples. Central Technical Issues in Programming Language Design. Sur Quelques Systèmes de Programmation pour les Recherches Scientifiques. Decision Problems in Computational Models. Non-Determined Algorithm Schemata or R-Schemata. Equivalence and Optimization of Programs. On the Average Speed of Automaton

with Terminal State. Local-Terminal Equivalence of Program Schemata. On Universal Classes of Program Schemas. Certain Decompositions of Gödel Numberings and the Semantics of Programming Languages. Criteria for the Algorithmic Completeness of the Systems of Operations. Data Flow Schemas. Operation Patterns. Looking for an Approach to a Theory of Models for Parallel Computation. Configurable Computers—A New Class of General Purpose Machines. A Method for Determining Program Data Relationships. Towards Automatic Construction of Parallel Programs. A Calculus for the Mathematical Theory of Computation. Admissibility of Fixed-Point Induction in First-Order Logic of Typed Theories. A Formal Approximation Theory of Semantic Data Types. Some Features of a Language for a Proof-Checking Programming System.

Volume 6

Matrix Eigensystem Routines—EISPACK Guide

By
B. T. Smith, J. M. Boyle, B. S. Garbow, Y. Ikebe, V. C. Klema, and C. B. Moler

1974. x, 387p. paper \$11.50

Contents

Introduction. How to Use EISPACK. Validation of EISPACK. Execution Times for EISPACK. Certification and Availability of EISPACK. Differences between the EISPACK Subroutines and the Handbook ALGOL Procedures. Documentation and Source Listings.

Volume 7

GI

Gesellschaft für Informatik e. V.

3. Fachtagung über Programmiersprachen Kiel, March 5-7, 1974

Edited by
B. Schlender, University of Kiel, Federal Republic of Germany, and **W. Frielinghaus**, Telefunken GmbH, Konstanz, Federal Republic of Germany

1974. vi, 225p. paper \$7.70

Contents

Zum Begriff der Modularität von Programmiersprachen. Entscheidbarkeitsprobleme bei der Übersetzung von Programmen mit einparametrischen Prozeduren. Eine axiomatische Studie zur Identifikation von Identifikatoren. Zur Übersetzbarkeit von Programmiersprachen. Über die Syntax von Dialogsprachen. Definition und Implementierung eines Dialogsystems. A Project Oriented Support Library. Feedback-Free Modularization of Compilers. Zur Minimalität des Hilfszellenbedarfs von systematisch übersetzten Ausdrücken. A PASCAL Compiler Bootstrapped on a DEC-System 10. Erfahrungen mit einem Parser-Generator für Chomsky-Grammatiken. Structured Programs, Arcadian Machines and the Burroughs B1700. Struktureinheiten in Kontextfreien Sprachen und ihre Übersetzung. ALSI—eine höhere Programmiersprache zur Transformation von ALGOL 68—Verbunden in SIMULA-Klassen. Interaktives Trace- und Debugging-System ALGOL KIEL X 8. Some Characteristics of RTL/2 and Their Relevance to Process Control. Prozessorientierte Programmiersprachen, Formen und Funktionen. Ein Vergleich von Prozess-Kontroll-Sprachen als Basis für den Normungsvorschlag einer internationalen Prozessrechnersprache.

Volume 8

GI-NTG

Fachtagung Struktur und Betrieb von Rechensystemen

Edited by
H.-O. Leilich, Technical University of Brunswick, Federal Republic of Germany

(4 contributions in English)
1974. vi, 340p. 126 illus. paper \$10.10

Contents

Hauptvortrag. Rechnerstrukturen. Schnittstellen und Leistungskriterien. Auftragslast, Leistung und Messung. Betriebsmittelvergabe.

Volume 9

GI-BIFOA

Internationale Fachtagung: Informationszentren in Wirtschaft und Verwaltung

Edited by
P. Schmitz, University of Cologne, Federal Republic of Germany

(3 contributions in English)
1974. vi, 259p. numerous illus. paper \$9.10

Contents

Hauptvortrag. Grundgedanken zur Entwicklung von Informationszentren. Informationszentren und Öffentliche Verwaltung. Informationszentren in Verschiedenen Bereichen. Informationszentren und Datenschutz. Sind Informationszentren Realisierbar? (Podiumsdiskussion).

Volume 10

Computing Methods in Applied Sciences and Engineering

Part 1

Edited by
R. Glowinski and J. L. Lions,
IRIA LABORIA, Domaine de
Voluceau—Rocquencourt,
France

(10 contributions in English)
1974. x, 497p. numerous illus.
paper \$14.00

Contents

Generalities. Finite Elements.
Non-Linear Problems. Networks
and Semi-Conductors.

Volume 11

Computing Methods in Applied Sciences and Engineering

Part 2

Edited by
R. Glowinski and J. L. Lions,
IRIA LABORIA, Domaine de
Voluceau—Rocquencourt,
France

(8 contributions in English)
1974. x, 434p. numerous illus.
paper \$12.30

Contents

Fluid Mechanics. Waves Prob-
lems. Optimal Control. Filtering
and Identification.

Volume 12

GFK-GI-GMR

Fachtagung
Prozessrechner 1974

Edited by
G. Krüger and R. Friehmelt,
Society for Nuclear Research, In-
stitute for Data Processing in
Technology, Karlsruhe, Federal
Republic of Germany

(3 contributions in English)
1974. xi, 620p. numerous illus.
paper \$17.30

Contents

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und Prozesssprachen. Realzeit-
Betriebssysteme. Übertragbarkeit
von Programmen.

Volume 13

Rechnerstrukturen und Betriebspro- grammierung

Erlangen, 1970

Edited by
W. Händler, University of
Erlangen-Nürnberg, Federal Re-
public of Germany, and
P. P. Spies, University of Bonn,
Federal Republic of Germany

(3 contributions in English)
1974. vii, 333p. numerous illus.
paper \$12.30

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Volume 14

Automata, Languages and Programming

2nd Colloquium,
University of Saarbrücken,
July 29-August 2, 1974

Edited by
J. Loecx, University of Saar-
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1974. viii, 611p. numerous illus.
paper \$19.70

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The Generative Power of Two-
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Volume 15

L Systems

Edited by
G. Rozenberg, Rijks University
at Utrecht, The Netherlands, and
A. Salomaa, University of
Aarhus, Denmark

1974. vi, 338p. paper \$12.30

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A Survey of Mathematical
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a General Framework.

Volume 16

Operating Systems

Proceedings of an
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Held at Rocquencourt,
April 23-25, 1974

Edited by
E. Gelenbe and **C. Kaiser**, IRIA
LABORIA, Domaine de Vol-
uceau, France

1974. viii, 310p. numerous illus.
paper \$12.30

Contents

Correctness of Realizations of
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Volume 17

Rechner-Gestützter Unterricht

RGU '74, Fachtagung,
Hamburg, August 12-14,
1974

Edited by
K. Brunnstein, University of
Hamburg, Federal Republic of
Germany, **K. Haefner**, Univer-
sity of Bremen, Federal Republic
of Germany, and **W. Händler**,
University of Erlangen, Federal
Republic of Germany

1974. x, 417p. 64 illus.
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English Contents

PROBE—A Computer-Based
Mastery Learning System. A
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E.S.P.A.C.E.—A Computer-
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Prospects. Computer-Based
Learning in the United States—
Some Local Observations. CAI
Activities in Switzerland.

Volume 18

PASCAL—User Manual and Report

2nd Edition

By
K. Jensen and **N. Wirth**, Insti-
tute for Computer Science, ETH
Zurich, Switzerland

1975. vi, 167p. paper \$8.20

Contents

User Manual. Notation and
Vocabulary. The Concept of
Data. The Program Heading and
the Declaration Part. The Con-
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range Types. Structured Types in
General—The Array in Particu-
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File Types. Pointer Types. Pro-
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How to Use the PASCAL 6000-
3.4 System. **Report.** Introduc-
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Input and Output. Programs. A
Standard for Implementation and
Program Interchange.

Volume 19

Programming Symposium

Proceedings, Colloque sur
la Programmation, Paris,
April 9-11, 1974

Edited by
B. Robinet, University of Paris,
France

(7 contributions in French, 22
contributions in English)
1974. v, 425p. 96 illus.
paper \$14.40

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Structured Programming. Pro-
gram Correctness. Proving Prop-
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Schematology. Theory of Pro-
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Parallel Processing. Formal
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Volume 20

Simple Program Schemes and Formal Languages

By
J. Engelfriet, Technical Univer-
sity Twente, The Netherlands

1974. vii, 254p. paper \$10.30

Contents

Introduction and Terminology.
An L-Scheme Approach to Pro-
gram Schemes. General Prop-
erties of Program Schemes. Some
Specific Problems Concerning
Program Schemes. Conclusions.
Indexes and References.

Volume 21

Compiler Construction— An Advanced Course

Edited by
F. L. Bauer and **J. Eickel**,
Technical University of Munich,
Federal Republic of Germany

1974. xiv, 621p. paper \$17.30

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Compiler Construction. Review
of Formalisms and Notation.
LL(1) Grammars and Analysers.
LR Grammars and Analysers.
Lexical Analysis. Transformational
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Grammars. Semantic Analysis.
Relationship of Languages to
Machines. Run-Time Storage
Management. Special Run-Time
Organization Techniques for
ALGOL 68. Symbol Table Ac-
cess. Code Generation. Assem-

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bly and Linkage. Introduction to Compiler-Compilers. Using the CDL Compiler-Compiler. Portable and Adaptable Compilers. Structuring Compiler Development. Programming Language Design. What the Compiler Should Tell the User. Optimization. Historical Remarks on Compiler Construction.

Volume 22

Formal Aspects of Cognitive Processes

Edited by
T. Storer and D. Winter, The University of Michigan, Ann Arbor

1975. v, 214p. paper \$9.50

Contents

Theories of the Brain; Behavior, The Mind, Robots and Cognitive Processes, Respectively. Two Classes of Holographic Processes Realizable in the Neutral Realm. Semantic Memory Retrieval—Some Data and a Model. Implication as an Alternative to Set-Inclusion as the Semantic Primitive. Structured-Storage AFA (Abstract). Predicate Calculus Feature Generation. A Mathematical Model for Perception Applied to the Perception of Pitch. Models of Speech Production. Towards a Theory of Linguistic Memory. The Grammar of Relative Adjectives and Comparison. A Simple Hierarchical Model of Natural Selection. On the Notion of a Rule. Empirical Restrictions on the Power of Transformational Grammars.

Volume 23

Programming Methodology

Edited by
C. E. Hackl, IBM Deutschland, Stuttgart, Federal Republic of Germany

(6 contributions in German)
1975. vi, 501p. 67 illus.
paper \$16.80

English Contents

On the Development of Systems of Men and Machines. A New Look at the Program Development Process. Organizing for Structured Programming. The Reliability of Programming Systems. ALGOL—A Structured Programming Language for APL. Software Engineering or Methods for the Multi-Person Construction of Multi-Version Programs. Knowledge and Reasoning in Program Synthesis. A New Approach to Program Testing. Interprocedural Analysis and the Information Derived by It. Automatic Programming. Non-Procedural Programming. Formal Definition in Program Development. Formalization—History, Present and Future.

Volume 24

Parallel Processing

Edited by
Tse-yun Feng, Syracuse University, New York

1975. vi, 433p. paper \$15.10

Contents

Scheduling I. Associative Processors. Modeling and Parallelism Detection. System Control. Scheduling II. RADCAP—The RADC Associative Processor. Panel—Parallel Processing—Past, Present, and Future. Computation Algorithms. System Architecture and Component Design. Parallel Processor Architectures for Air Traffic Control.

Volume 25

Category Theory Applied to Computation and Control

Edited by
E. G. Manes, University of Massachusetts, Amherst

1975. x, 245p. paper \$10.80

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Introduction: Basic Concepts of Category Theory Applicable to Computation and Control. A Control Theorist Looks at Abstract Nonsense. A Categorist's View of Automata and Systems. **Submitted Abstracts:** Categorical Theory of Tree Processing. Realization of Multilinear and Multidecomposable Machines. Fuzzy Morphisms in Automata Theory. Time-Varying Systems. Addressed Machines and Duality. Factorization of Scott-Type Automata. An Abstract Machine Theory for Formal Language Parsers. Some Structural Properties of Automata Defined on Groups. Automata in Additive Categories with Applications to Stochastic Linear Automata. The Algebraic Theory of Recursive Program Schemes. Realization Is Continuously Universal. Diagram Characterization of Recursion. Power and Initial Automata in Pseudoclosed Categories. Semantics of Computation. Scattering Theory and Non-Linear Systems. Synthesis and Complexity of Logical Systems. Strukturelle Verwandtschaften von Semi-Thue-Systemen. Control of Linear Continuous-Time Systems Defined over Rings of Distributions. Cellular Automata with Additive Local Transition. Automata in Semimodule Categories. Representation of a Class of Nonlinear Systems. Duals of Input/Output Maps. An Algebraic Formulation of the Chomsky Hierarchy. On the Recursive Specification of Data Types. Linear Systems over Rings of Operators. The Tricategory Theory of System Design.

Volume 26

GI-4. Jahrestagung Berlin, October 9-12, 1974

Edited by
D. Siefkes, Technical University of Berlin, Federal Republic of Germany

(29 contributions in English)
1975. ix, 748p. paper \$20.10

Contents

Hauptvorträge. Theoretische Grundlagen. Programmiersprachen und Compiler. Nichtsequentielle Systeme. Betriebssysteme. Rechnerarchitektur und Bewertung. Informationssysteme. Computer Graphics. Anwendung—Geographie, Konstruieren. Ausbildung.

Volume 27

Optimization Techniques—IFIP Technical Conference Novosibirsk, July 1-7, 1974

Edited by
G. I. Marchuk, Computer Center, Novosibirsk, USSR

1975. viii, 507p. paper \$16.80

Contents

System Modeling and Identification. Optimal Control. Mathematical Programming and Numerical Algorithms. Theory of Games.

Volume 28

Mathematical Foundations of Computer Science

Edited by
A. Blikle, Polish Academy of Sciences, Warsaw, Poland

1975. viii, 484p. paper \$16.00

Contents

Automata Theory. Computing Systems. Cooperating Processes and Simulation. Formal Languages. Mathematical Aspects of Application Methodology. Theory of Programs.

Volume 29

Interval Mathematics

Edited by
K. Nickel, University of Karlsruhe, Federal Republic of Germany

(12 contributions in English)
1975. vi, 331p. paper \$12.90

English Contents

A Generalized Interval Arithmetic. Two-Sided Approximation to Solutions of Nonlinear Operator Equations—A Comparison of Methods from Classical Analysis, Functional Analysis, and Interval Analysis. Tools for the Analysis of Interval Arithmetic. A Posteriori Component-Wise Error Estimation of Approximate Solutions to Nonlinear Equations. A Distribution-Free Interval Mathematical Analysis of Probability Density Functions. Monotonically Convergent Numerical Two-Sided Bounds for a Differential Birth and Death Process. The Condition Problem in Solution of Linear Multistage Systems. Parallel Square Root Iterations. On Approximate Iterations and Solutions for Equations Considered in Function Spaces. The Error in Interval Arithmetic. Interval-Extension of Quasilinearization Method.

Volume 30

Software Engineering An Advanced Course

Edited by
F. L. Bauer, Technical University of Munich, Federal Republic of Germany

Reprint of the first edition
1975. xii, 545p. paper \$18.10

Contents

Introduction: What the Software Engineer Can Do for the Computer User. The Design and Construction of Software Systems. **Descriptive Tools:** Hierarchies. Language Characteristics. Low Level Languages—Summary of a Discussion Session. Relationship between Definition and Implementation of a Language. Concurrency in Software Systems. **Techniques:** Modularity. Portability and Adaptability. Debugging and Testing. Reliability. **Practical Aspects:** Project Management. Documentation. Performance Prediction. Performance Measurement. Pricing Mechanisms. Evaluation in the Computer Center Environment. **Appendix:** Software Engineering.

Volume 31

Analysis of Drum and Disk Storage Units

By
S. H. Fuller, Carnegie-Mellon University, Pittsburgh, Pennsylvania

1975. ix, 283p. paper \$12.10

Contents

Introduction. An Analysis of Drum Storage Units. Performance of an I/O Channel with Multiple Paging Drums. An Optimal Drum Scheduling Algorithm. The Expected Difference between the SLTF and DTPT Drum. Random Arrivals

and MTPT Disk Scheduling Disciplines. Appendix A: A Simulator of Computer Systems with Storage Units Having Rotational Delays. Appendix B: Implementation of the MTPT Drum Scheduling Algorithm. Appendix C: Some Efficient Algorithms and Data Structures for Handling Permutations. Appendix D: An Alternate Derivation of $Q(z)$ —The Moment Generating Function of Sector Queue Size.

Volume 32

Mathematical Foundations of Computer Science 1975

Edited by
J. Bečvář, Czechoslovak Academy of Sciences, Prague

1975. x, 476p. paper \$16.80

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Invited Lectures:

Construction of Complete Sample System for Correctness Testing. Ten Years of Speedup. On Logics of Discovery. On Models of Protection in Operating Systems. Parsing as a Subtask of Compiling. Parallel Recursive Program Schemes. On Some Problems Concerning Pawlak's Machines. Formal Power Series and Growth Functions of Lindenmayer Systems. On the Representability of Relations by Deterministic and Nondeterministic Multi-Tape Automata. On Problems Solvable by Successive Trials. Automata and Categories. On Some Models of Computability of Boolean Functions. **Communications:** Automata and Categories. Languages over Free Groups. On the Comparison of Notions of Approximation. Non-Linear Speed-Up Theorem for Two Register Minsky Machines. Systems of Open Paths in Petri Nets. On the Largest Full Sub-AFL of the Full AFL of Context-Free Languages. On Complexity of Nondeterministic Turing Machines Computations. On Closure Properties

of Context-Free Derivation Complexity Classes. Control Structures in Single Block Programs. Minimal Gödel Numbers and Their Identification in the Limit. Isomorphic Representation of Automata. Extended Simple Regular Expressions. CONNIVER Programs by Logical Point of View. On the Set of All Automata with the Same Monoid of Endomorphisms. Nondeterministically Recognizable Sets of Languages. The Approximation Problem in Computational Statistics. The Continuous Algebra of Monadic Languages. On Sets of Complex-Programmed Numbers. Decision Algorithms for Havel's Branching Automata. Automata and Categories—Input Processes. Formalization of Algorithmic Reasoning. Proving Program Properties, Symbolic Evaluation and Logical Procedural Semantics. A Contribution to Error Recovery. On the Analysis and Synthesis Problems for Context-Free Expressions. Monotone Switching Circuits and Boolean Matrix Product. On Some Lattice-Theoretic Properties of Generable Languages. On Some Formal Grammars Generating Dependency Trees. Graph Walking Automata. On Finding All Solutions of the Partitioning Problem. Greibach Normal Form Complexity. On Correctness and Essentiality of Some Ianov Schemas Equivalence Relations. Polynomially Complete Problems in the Logic of Automated Discovery. Relational Definition of Computer Languages. First-Order Reduction of Call-by-Name to Call-by-Value. Local Disambiguating Transformation. On Cardinal Sequential Outer Measures. On Representation of Sequential and Parallel Functions. The Theory of the Modified Post Algebras and Multidimensional Automata Structures. An Algebraic Theory of Formal Languages. On Polynomial Reducibility of Word Problem under Embedding of Recursively Presented Groups in Finitely Presented Groups. On the Synthesis of Automata with Sev-

Continued

eral Initial States. A Hierarchy of Regular Sequence Sets. R-Fuzzy Grammars. Characterization of Some Classes of Context-Free Languages in Terms of Complexity Classes. Inductive Inference of Recursive Functions. Proving Properties of Programs by Means of Predicate Logic. A Generalization of Scott's Flow Diagrams.

Volume 33

Automata Theory and Formal Languages—2nd GI Conference

Kaiserslautern, May 1975

Edited by
H. Brakhage, University of Kaiserslautern, Federal Republic of Germany

1975. viii, 292p. paper \$11.50

English Contents

Formal Language Theory and Theoretical Computer Science. Best Possible Bounds for the Weighted Path Length of Optimum Binary Search Trees. Statistical Characterization of Learnable Sequences. The Complexity of Negation-Limited Networks—A Brief Survey. The Network-Complexity of Equivalence and Other Applications of the Network Complexity. On the Entropy of a Formal Language. On the Complexity of Computations under Varying Sets of Primitives. About the Deterministic Simulation of Non-deterministic (log n)-Tape Bounded Turing Machines. Quantifier Elimination for Real Closed Fields by Cylindrical Algebraic Decomposition. On the Generative Capacity of the Strict Global Grammars. Tree-Transducers and Syntax-Connected Transductions. Piecewise Testable Events. Formal Translations and the Containment Problem for Szilard Languages. A Characterization of Bounded Regular Sets. Analyzing Families of Grammars. Control Structures and Monadic Languages.

Volume 34

GI-5. Jahrestagung

Edited by
J. Mühlbacher, University of Dortmund, Federal Republic of Germany

1975. x, 755p. paper \$24.20

English Contents

Information Systems—A Survey by Examples. The Problem of Requirements Analysis for Information Systems Applications. 'Variables Considered Harmful'. L Systems, Sequences and Languages. Introducing Parallelism into Sequential Programs. Well Formed Programs Optimal with Respect to Structural Complexity. Merging Contro-Flow and Data-Flow Descriptions of Structured Systems in a Unique Notation. The Construction of Types of Abstract Machines in SIMAC. On the Semantics of Data Bases—The Semantics of Data Definition Languages. A System to Increase Data Independence in a Hierarchical Structure. An Attribute Represented as a Data Item or Databasekey—A Basic Defect in the CODASYL DDL 1973 and Its Correction. Problems of the Change of Operating Time of Finite Automata. Experience of a Departmental Computer Support Network. An Integrated System for Application Programs and Data Base Management. Pattern Matching and Call by Pattern. On the Design of Programming Languages Including Mini ALGOL 68. Polynomial Separation of Ternary Functions. A Model of a Time-Sharing System with Two Classes of Processes. SLS/1—A Translator Writing System. An Abstract ALGOL 68 Machine and Its Application in a Machine Independent Compiler. First Order Logic as a Tool to Solve and Classify Problems. On Evaluating Recursion. Analogy Categories, Virtual Machines and Structured Programming. Performances of 'Least Reference Probability' Paging Algorithm under Locality in Program Behavior. The Logic of Protection.

Volume 35

Exercises in Computer Systems Analysis

By
W. Everling, University of Bonn, Federal Republic of Germany

Corrected reprint of the first edition

1975. vii, 184p. paper \$8.20

Contents

Communications Network Design: Some Statistical Analysis of Design Data. Line Service Times and Utilization. First Concepts and Relations of Queuing Theory. A First Result on the Single-Server Queue. A General Result on the Single-Server Queue. Terminal Systems with Polling. Some Results on Queues with Priority Disciplines. Some Applications of Markov Processes. **Computer Center Analysis:** Core Buffer Requirements. Service Times of Direct-Access Storage Devices. Queuing for Data Accesses. Final Remarks on the Computer Center Analysis. **Further Results of Queuing Theory:** Imbedded Markov Chains of Some Queuing Processes. Limit Utilization and Wait Time Distributions. Appendices.

Volume 36

Theory of Program Structures: Schemes, Semantics, Verification

By
S. A. Greibach, University of California, Los Angeles

1975. xv, 331p. paper \$13.20

Contents

Introduction. Program Schemes—Basic Definitions and Concepts. Program Schemes—Basic Properties. Structured Programs. Correctness and Program Verification. Decision

Problems. Recursion Schemes. Monadic Recursion Schemes. Appendix A: Program Schemes and the First Order Predicate Calculus. Exercises.

Volume 37

λ -Calculus and Computer Science Theory

Proceedings of the Symposium Held in Rome, March 25-27, 1975

Edited by
C. Böhm, University of Rome, Italy

1975. xii, 370p. paper \$13.20

Contents

Introduction. Combinators and Classes. Least Fixed Points Revisited. Infinite Normal Forms for the λ -Calculus. A Survey of Some Useful Partial Order Relations on Terms of the Lambda Calculus. λ -Terms as Total or Partial Functions on Normal Forms. Continuous Semantics and Inside-Out Reductions. An Algebraic Interpretation of the $\lambda\beta\kappa$ -Calculus and a Labelled λ -Calculus. Les Modèles Informatiques des λ -Calculs. On the Description of Time Varying Systems in λ -Calculus. Unification in Typed Lambda Calculus. A Condition for Identifying Two Elements of Whatever Model of Combinatory Logic. Typed Meaning in Scott's λ -Calculus Models. Programming Language Semantics in a Typed Lambda-Calculus. Big Trees in a λ -Calculus with λ -Expressions as Types. Normed Uniformly Reflexive Structures. A Model with Non-Deterministic Computation. On Subrecursiveness in Weak Combinatory Logic. Sequentially and Parallely Computable Functionals. Computation on Arbitrary Algebras. On Solvability by λ -Terms. Some Philosophical Issues Concerning Theories of Combinators. Open Problems.

Volume 38

An Optimized Translation Process and Its Application to ALGOL 68

By
P. Branguart, J.-P. Cardinael, J. Lewi, J.-P. Delescaille, and M. Vanbegin, MBLE Research Laboratory, Brussels, Belgium

1976. ix, 334p. paper \$12.30

Contents

General Principles: Introduction. Recall of Storage Allocation Principles. Study of the Static Properties of Values. Study of the Prevision Mechanism. **Details of Translation into Intermediate Code:** Introduction. Lexicographical Blocks. Mode Identifiers. Generators. Label Identifiers. Non-Standard Routines with Parameters. Non-Standard Routines without Parameters. Procedured Jumps. Bounds of Mode Declarations. Dynamic Replications in Formats. Other Terminal Constructions. Kernel Invariant Constructions. Confrontations. Call of Standard Routines. Choice Constructions. Collateral Clauses. Miscellaneous. Other ICIS. **Translation into Machine Code:** Generalities. Accesses and Machine Addresses. Method of Code Generation. Local Optimizations. The Loader. Translation of Intermediate Code Modules. Further Remarks on Garbage Collection.

Volume 39

Data Base Systems

5th Informatik Symposium,
IBM Germany,
Bad Homburg, v.d.H.,
September 1975

Edited by
H. Hasselmeier and W. G. Spruth,
IBM Deutschland, Böblingen,
Federal Republic of Germany

1976. vi, 386p. paper \$13.20

English Contents

On the Relationship between Information and Data. Data Base Research—A Survey. System R—A Relational Data Base Management System. Geographic Base Files—Applications in the Integration and Extraction of Data from Diverse Sources. Data Base User Languages for the Non-Programmer. Relational Data Dictionary Implementation. Data Base System Evaluation. On the Integrity of Data Bases and Resource Locking. Data Base Standardization—A Status Report

Volume 40

Optimization Techniques

Modeling and Optimization in the Service of Man

Part 1

Proceedings, 7th IFIP Conference
Nice, September 8-12, 1975

Edited by
J. Cea, Nice, France

(50 contributions in English)
1976. xiv, 854p. paper \$25.50

Contents

Invited Speakers. Medicine and Biology. Human Environment (Water Pollution). Human Environments (Sociology, Urban Systems, Physics, Chemistry). Human Environments (Energy, World Models). Operational Research. Associated Software Problems.

Volume 41

Optimization Techniques

Modeling and Optimization in the Service of Man

Part 2

Proceedings, 7th IFIP Conference
Nice, September 8-12, 1975

Edited by
J. Cea, Nice, France

(40 contributions in English)
1976. xiii, 852p. paper \$25.50

Contents

Games. Optimal Design. Computational Techniques. Mathematical Programming. Optimal Control Deterministic. Optimal Control Stochastic.

Volume 42

Complementary Definitions of Programming Language Semantics

By
J. E. Donahue, Cornell University, Ithaca, New York

1976. vii, 172p. paper \$8.20

Contents

Introduction. History and Literature Review. Basic Elements of the Lattice-Theoretic Approach. Complementary Definitions of a PASCAL Subset. Consistency of the PASCAL Subset Definitions. Extensions to the PASCAL Subset Language. Conclusions and Directions for Future Research.

Volume 43

Komplexität von Entscheidungsproblemen

Ein Seminar

Edited by
E. Specker and V. Strassen

1976. v, 217p. paper \$9.50

Contents

Zeitlich beschränkte Turingmaschinen und polynomielle Reduktion. Polynomial beschränkte nichtdeterministische Turingmaschinen und die Vollständigkeit des aussagelogischen Erfüllungsproblems. Probleme, die zum Erfüllungsproblem der Aussagenlogik polynomial äquivalent sind. Weitere zum Erfüllungsproblem polynomial äquivalente kombinatorische Aufgaben. Ein polynomialer Algorithmus zur Bestimmung unabhängige Repräsentantensysteme. Polynomielle Transformationen und Auswahlaxiom. Spektralproblem und Komplexitätstheorie. Untere Schranken für die Komplexität logischer Entscheidungsprobleme. Ein Entscheidungsverfahren für die Theorie der reell-abgeschlossenen Körper. Simulation von Turingmaschinen mit logischen Netzen. Längen und Formeln.

Volume 44

**ECI Conference
1976**

Proceedings of
the 1st Conference of
the European Cooperation
in Informatics

Amsterdam, August 9-12,
1976

Edited by

K. Samelson, University of
Munich, Federal Republic of
Germany

1976. viii, 322p. paper \$12.30

Contents**Computer Architecture and
Computer Systems Structure:**

Names and Objects in
Heterogeneous Computer Net-
works. Trends in Computer Sys-
tem Structure and Architecture.
Aspects of the Communication
Within a Multisuppliers Compu-
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**Concepts and Techniques of
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COBOL Monitor System.

Volume 45

**Mathematical
Foundations of
Computer Science
1976**

Proceedings,
5th Symposium
Gdańsk, September 6-10,
1976

Edited by

A. Mazurkiewicz, Polish
Academy of Sciences, Warsaw,
Poland

1976. xi, 606p. paper \$18.90

Contents

Invited Lecturers: Exercises in
Denotational Semantics.
W-Automata and their Lan-
guages. On Semantic Issues in
the Relational Model of Data.
The Effective Arrangement of
Logical Systems. Recursivity,
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Analysis of the Non-
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Equational Classes of Languages
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A Machine Independent Descrip-
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Schemes with Recursion on
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Semigroup Characterizations of
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Error Detection Using Regular
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Transformer, Non-Determinism,
Recursion, and Termination.
Context-Free Programmed
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Context-Free Algebra: A
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of Parallelism in Computations.
On Adaptability of a System of
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ling of Non-Sequential Proces-
ses. Equivalence and Optimization
of Recursive Program Schemata.
Observability Concepts in
Abstract Data Type Specifica-
tion. The Calculus of Facts. Mul-
tiplicity Functions on ω -Automata.

2

A complete listing of Texts and Monographs in Computer Science

Edited by

F. L. Bauer, Technical University
of Munich, Federal Republic of
Germany

D. Gries, Cornell University,
Ithaca, New York

Design of Digital Computers

An Introduction
2nd edition

By

H.W. Gschwind, Standard Elek-
trik Lorenz AG, Stuttgart, Fed-
eral Republic of Germany, and
E.J. McCluskey, Digital Sys-
tems Laboratory, Stanford,
California

1975. ix, 548p. 375 illus.
cloth \$19.50

Design of Digital Computers is a thorough revision of Gschwind's popular text for undergraduate and graduate courses in computer design and electrical engineering. It is a comprehensive treatment of the methods of computer design, the basic components and units of digital computers, and the philosophy of their organization. Professor McCluskey has completely rewritten the chapter on integrated circuit gates; all other chapters have been extensively revised and updated to reflect the latest developments in digital computer design. The text includes a large number of interesting and challenging problems; references and a selected bibliography are also included. A solutions manual is available for instructors.

Contents

Introduction. Number Systems and Number Representations. Boolean Algebra. Integrated Circuit Gates. Storage Elements. Computer Circuits. The Basic Organization of Digital Computers. The Functional Units of a Digital Computer. Unorthodox Concepts. Miscellaneous Engineering and Design Considerations.

The Origins of Digital Computers

Selected Papers
2nd edition

Edited by

B. Randell, The University of
Newcastle Upon Tyne, England

1975. xvi, 464p. 120 illus. cloth
\$14.90

"This superb book is by far the best extant collection of historical material about the early development of digital computing machines, and in fact it is difficult to imagine how anyone could ever improve upon it substantially. Professor Randell has done a truly masterful job, maintaining a high standard of scholarship throughout. . . . The editor's capable summaries at the beginning of each section are so

Continued

beautifully done that they are perhaps the most important part of the book. . . . In summary, this monumental book should be on every computer scientist's bookshelf, and should set a standard of excellence for future historians of computer science and technology. . . .

Historia Mathematica

Contents

Introduction. Analytical Engines. Tabulating Machines. Zuse and Schreyer. Aiken and IBM. Bell Telephone Laboratories. The Advent of Electronic Computers. Stored Program Electronic Computers.

Adaptive Information Processing

An Introductory Survey

By

J. R. Sampson, The University of Alberta, Edmonton, Alberta, Canada

1976. x, 214p. 83 illus. cloth \$14.80

This book unifies and presents, at a level appropriate to undergraduate computer science majors, selected topics in automata theory, biological information processing, and artificial intelligence. The material is suitable for a one semester course. Since the three parts of the book are essentially self-contained, it can also serve as an adjunct in more specialized computer sci-

ence courses as well as a reference work for students in other disciplines (e.g., mathematics, psychology, biology).

Contents

Introduction. **Information and Automata:** Communication Theory. Coding Information. Finite Automata. Turing Machines. Cellular Automata. **Biological Information Processing:** Biochemical Coding and Control. Genetic Information Transmission. Neural Information Transmission. Neural Input-Output. Computer Simulation Models. **Artificial Intelligence:** Pattern Recognition. Game Playing. Theorem Proving. Problem Solving. Natural Language Processing.

Chess Skill in Man and Machine

By

P. W. Frey

In preparation

Section

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A selection from Die Grundlehren der mathematischen Wissenschaften

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Institute of Mathematics,

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A. Grothendieck, E. Heinz, F. Hirzebruch,
E. Hopf, S. Mac Lane, W. Magnus,
M. M. Postnikov, F. K. Schmidt,
W. Schmidt, D. S. Scott, K. Stein,
J. Tits, B. L. van der Waerden

Volume 135

Handbook for Automatic Computation

Edited by

F. L. Bauer,
A. S. Householder,
F. W. J. Olver, H. Rutishauser,
K. Samelson, E. Stiefel

Volume 1/Part A

Description of ALGOL 60

By

H. Rutishauser, Federal Technical University of Zurich, Switzerland

1967. xii, 323p. cloth \$24.40

Contents

Introduction. Basic Concepts. Expressions. Statements. Miscellaneous Applications. Declarations. Procedures. Input and Out-

put. Appendix A: The Jensen Device. Conclusion. Appendix B: The IFIP-Report on ALGOL.

Volume 137

Handbook for Automatic Computation

Volume 1/Part B

Translation of ALGOL 60

By

A. A. Grau, Northwestern University, Evanston, Illinois,
U. Hill, Technical University of Munich, Federal Republic of Germany, and **H. Langmaack**, Purdue University, Lafayette, Indiana

1967. ix, 397p. cloth \$30.40

Contents

Introduction. Principles of ALGOL Translation. Languages Involved in the Translation Pro-

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cess. Correspondence between Elements of Source and Target Language. Recursive Address Calculation. Run Time Organization. Model Translator—Description. ALGOL 60 Model Translator—Formal Part.

Volume 181

Non-Homogeneous Boundary Value Problems and Applications

Volume 1

By **J. L. Lions**, University of Paris, France, and **E. Magenes**, University of Pavia, Italy

Translated from the French by **P. Kenneth**

1972. xv, 358p. cloth \$26.90

Contents

Hilbert Theory of Trace and Interpolation Spaces: Some Function Spaces. Intermediate Derivatives Theorem. Trace Theorem. Trace Spaces and Non-Integer Order Derivatives. Interpolation Theorem. Reiteration Properties and Duality of the Spaces $[X, Y]_\theta$. The Spaces $H^s(\mathbb{R}^n)$ and $H^s(\Gamma)$. Trace Theorem in $H^m(\Omega)$. The Spaces $H^s(\Omega)$, Real $s \geq 0$. Some Further Properties of the Spaces $[X, Y]_\theta$. Subspaces of $H^s(\Omega)$. The Spaces $H^s_\delta(\Omega)$. The Spaces $H^{-s}(\Omega)$, $s > 0$. Intersection Interpolation. Holomorphic Interpolation. Another Intrinsic Definition of the Spaces $[X, Y]_\theta$. Compactness Properties. Comments. Problems. **Elliptic Operators. Hilbert Theory:** Elliptic Operators and Regular Boundary Value Problems. Green's Formula and Adjoint Boundary Value Problems. The Regularity of Solutions of Elliptic Equations in the Interior of Ω . A priori Estimates in the Half-Space. A priori Estimates in the Open Set Ω and the Existence of Solutions in $H^s(\Omega)$ -Spaces, with Real $s \geq$

$2m$. Application of Transposition: Existence of Solutions in $H^s(\Omega)$ -Spaces, with Real $s \leq 0$. Application of Interpolation: Existence of Solutions in $H^s(\Omega)$ -Spaces, with Real s , $0 < s < 2m$. Complements and Generalizations. Variational Theory of Boundary Value Problems. Comments. Problems. **Variational Evolution Equations:** An Isomorphism Theorem. Transposition. Interpolation. Example: Abstract Parabolic Equations, Initial Condition Problem (I). Example: Abstract Parabolic Equations, Initial Condition Problem (II). Example: Abstract Parabolic Equations, Periodic Solutions. Elliptic Regularization. Equations of the Second Order in t . Equations of the Second Order in t ; Transposition. Schroedinger Type Equations. Schroedinger Type Equations; Transposition. Comments. Problems.

Volume 182

Non-Homogeneous Boundary Value Problems and Applications

Volume 2

By **J. L. Lions**, University of Paris, France, and **E. Magenes**, University of Pavia, Italy

Translated from the French by **P. Kenneth**

1972. xi, 242p. cloth \$19.80

Contents

Parabolic Evolution Operators. Hilbert Theory: Notation and Hypotheses; First Regularity Theorem. The Spaces $H^{r,s}(Q)$; Trace Theorems; Compatibility Relations. Evolution Equations and the Laplace Transform. The Case of Operators Independent of t . Regularity. Case of Time-Dependent Operators; Existence of Solutions in the Spaces $H^{2m,m}(Q)$, Real $\gamma \geq 1$. Adjoint Isomorphism of Order γ . Transposition of the Adjoint Isomor-

phism of Order γ ; (I): Generalities. Choice of f ; The Spaces $\Xi^{2mr,r}(Q)$. Trace Theorems for the Spaces $D_p^{-(r-1)}(Q)$, $r \geq 1$. Choice of g_j and u_0 ; The Spaces $H^{2am} \Xi^\alpha(\Sigma)$. Transposition of the Adjoint Isomorphism of Order γ ; (II): Results; Existence of Solutions in $H^{2mr,r}(Q)$ -Spaces, Real $\gamma \leq 0$. State of the Problem; Complements on the Transposition of the Adjoint Isomorphism of Order 1. Some Interpolation Theorems. Final Results: Existence of Solutions in the Spaces $H^{2mr,r}(Q)$, $0 < r < 1$; Applications. Comments. Problems.

Hyperbolic Evolution

Operators, of Petrowski and of Schroedinger. Hilbert Theory:

Application of the Results of Chapter 3 and General Remarks. A Regularity Theorem (I). Regular Non-Homogeneous Problems. Transposition. Interpolation. Applications and Examples. Regularity Theorem (II). Non-Integer Order Regularity Theorem. Adjoint Isomorphism of Order γ and Transposition. Choice of f , $\tilde{g}$, u_0 , u_1 . Trace Theorems in the Space $D^{-2(r-1)}(Q)$. Schroedinger Type Equations. Comments. Problems. **Applications to Optimal Control Problems:** Statement of the Problems for the Linear Parabolic Case. Choice of the Norms in the Cost Function. Optimality Condition for Quadratic Cost Functions. Optimality Condition and Green's Formula. The Particular Case $\mu = m + 1/2$, $E_3 \neq 0$. Consequences of the Optimality Condition (I). Consequences of the Optimality Condition (II). Complements on the Choice of the Spaces K_t . Examples. Non-Parabolic Cases; Statement of the Problems; Generalities. Applications; Examples. Comments. Problems. **Appendix: Boundary Value Problems and Operator Extensions:** Statement of the Problem; Well-Posed Spaces. Abstract Boundary Conditions. Example 1. Elliptic Operators. Example 2. Parabolic Operators. Example 3. Evolution Operators of the Second Order in t . Comments and Problems.

Volume 186

Handbook for Automatic Computation

Volume 2

Linear Algebra

By

J. H. Wilkinson, National Physical Laboratory, Teddington, Middlesex, England, and **C. Reinsch**, Technical University of Munich, Federal Republic of Germany

1971. ix, 439p. cloth \$29.60

Contents

Linear Systems. Least Squares and Linear Programming: Introduction to Part 1. Symmetric Decomposition of a Positive Definite Matrix. Iterative Refinement of the Solution of a Positive Definite System of Equations. Inversion of Positive Definite Matrices by the Gauss-Jordan Method. Symmetric Decomposition of Positive Definite Band Matrices. The Conjugate Gradient Method. Solution of Symmetric and Unsymmetric Band Equations and the Calculation of Eigenvectors of Band Matrices. Solution of Real and Complex Systems of Linear Equations. Linear Least Square Solutions by Householder Transformations. Elimination with Weighted Row Combinations for Solving Linear Equations and Least Square Problems. Singular Value Decomposition and Least Square Solutions. A Realization of the Simplex Method Based on Triangular Decompositions. **The Algebraic Eigenvalue Problem:** Introduction to Part 2. The Jacobi Method for Real Symmetric Matrices. Householder's Tridiagonalization of a Symmetric Matrix. The QR and QL Algorithms for Symmetric Matrices. The Implicit QL Algorithm. Calculation of the Eigenvalues of a Symmetric Tridiagonal Matrix by the Method of Bisection. Rational QR Transformation with Newton Shift for Symmetric Tridiagonal

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Matrices. The *QR* Algorithm for Band Symmetric Matrices. Tridiagonalization of a Symmetric Band Matrix. Simultaneous Iteration Method for Symmetric Matrices. Reduction of the Symmetric Eigenproblem $Ax = \lambda Bx$ and Related Problems to Standard Form. Balancing a Matrix for Calculation of Eigenvalues and Eigenvectors. Solution to the Eigenproblem by a Norm Reducing Jacobi Type Method. Similarity Reduction of a General Matrix to Hessenberg Form. The *QR* Algorithm for Real Hessenberg Matrices. Eigenvectors of Real and Complex Matrices by *LR* and *QR* Triangularizations. The Modified *LR* Algorithm for Complex Hessenberg Matrices. Solution to the Complex Eigenproblem by a Norm Reducing Jacobi Type Method. The Calculation of Specified Eigenvectors by Inverse Iteration.

Volume 193

Problems and Theorems in Analysis

Volume 1

Series. Integral Calculus. Theory of Functions.

By

G. Pólya and G. Szegő, Stanford University, California

Translated from the German by **D. Aepli**

Revised and enlarged translation of *Aufgaben und Lehrsätze aus der Analysis I*, 4th edition, 1970; Heidelberger Taschenbücher, Band 73

1972. xix, 389p. cloth \$34.00

Contents
Infinite Series and Infinite Sequences: Operations with Power Series. Linear Transformations of Series: A Theorem of Cesàro. The Structure of Real Sequences and Series. Miscellaneous Problems. **Integration:** The Integral as the Limit of a Sum of Rectangles. Inequalities. Some Properties of Real Functions. Various Types of Equidistribution. Functions of Large Numbers. **Functions of One Complex Variable. General Part:** Complex Numbers and Number Sequences. Mappings and Vector Fields. Some Geometrical Aspects of Complex Variables. Cauchy's Theorem—The Argument Principle. Sequences of Analytic Functions. The Maximum Principle.

Volume 216

Problems and Theorems in Analysis

Volume 2

Theory of Functions. Zeros. Polynomials. Determinants. Number Theory. Geometry.

By

G. Pólya and G. Szegő, Stanford University, California

Translated from the German by **C. E. Billigheimer**

Revised and enlarged translation of *Aufgaben und Lehrsätze aus der Analysis II*, 4th edition, 1971; Heidelberger Taschenbücher, Band 74

1976. xi, 392p. 2 figs. cloth \$45.10

Contents
Functions of One Complex Variable. Special Part: Maximum Term and Central Index, Maximum Modulus and Number of Zeros. Schlicht Mappings. Miscellaneous Problems. **The Location of Zeros:** Rolle's Theorem and Descartes' Rule of Signs. The Geometry of the Complex Plane and the Zeros of Polynomials. Miscellaneous Problems. **Polynomials and Trigonometric Polynomials. Determinants and Quadratic Forms. Number Theory:** Arithmetical Functions. Polynomials with Integral Coefficients and Integral-Valued Functions. Arithmetical Aspects of Power Series. Some Problems on Algebraic Integers. Miscellaneous Problems. **Geometric Problems.**

Volume 219

Inequalities in Mechanics and Physics

By

G. Duvaut, University of Paris, France, and **J. L. Lions**, College of France, Paris

Translated from the French by **C. W. John**

1976. xvi, 397p. 28 figs. cloth \$40.20

Contents
 Problems of Semi-Permeable Media and of Temperature Control. Problems of Heat Control. Classical Problems and Problems with Friction in Elasticity and Visco-Elasticity. Unilateral Phenomena in the Theory of Flat Plates. Introduction to Plasticity. Rigid Visco-Plastic Bingham Fluid. Maxwell's Equations. Antenna Problems.

4

A selection from
**Lecture Notes in
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Volume 105

**Optimal Control
 Theory and
 Its Applications**

Part 1

Edited by
B. J. Kirby, Queens University,
 Kingston, Ontario, Canada

1974. vi, 425p. paper \$14.40

Contents

Modeling of Control and Dynamical Systems in the Life Sciences. Necessary Conditions in Mathematical Programming and Optimal Control Theory. Various Topics in the Theory of Optimal Control of Distributed Systems. Game Theory and Some Interfaces with Control Theory. Linear Multivariable Control.

Volume 106

**Optimal Control
 Theory and
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Part 2

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B. J. Kirby, Queens University,
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1974. vi, 403p. paper \$14.40

Contents

Applications of the Fredholm Alternative to Controllability of Functional Differential Equations. Convergence of Projection Series for Functional Differential Equations with Applications to Control Theory. The Candidate Model. Optimal Control Theory and Renewable Resource Management. Necessary Conditions for Nonsmooth Variational Problems. Linear Hereditary Differential Systems and Their Control. On Finding Solutions Which Dominate Equilibrium Solutions to Some N-Person Differential Games. An Approximate Convolution Equation of a Given Response. On Reachable Sets. At-

Continued

tainable Sets and Controllability; A Geometric Approach. The Quadratic Criterion Problem for Systems Governed by Retarded Functional Differential Equations and a Modal Analysis Approximation Procedure. Cheap Control, Singular Arcs, and Singular Perturbations. Optimal Control Problems with a Convex and Compact Control Region. Optimal Control Problems in Advertising. An Application of the Maximum Principle to a Heterogeneous Labor Model with Retarded Controls. Remarks on Some Basic Concepts of Optimal Control.

Volume 107

Control Theory, Numerical Methods and Computer Systems Modelling

Edited by
A. Bensoussan and J. L. Lions,
IRIA LABORIA, Domaine de
Voluceau—Racquencourt,
France

1975. viii, 757p. paper \$22.80

Contents

Filtering Theory. Game Theory. Control of Stochastic Distributed Parameter Systems and Random Fields Stochastic Control. Discrete Time Problems and Numerical Methods. Control of Distributed Parameter Systems. Control of Jump Processes and Computer Model Applications. Free Boundary Value Problems and Control Theory. Applications of Control Theory in Economics, Process Control and Pattern Recognition.

Volume 108

Supercritical Wing Sections 2 A Handbook

By

F. Bauer, P. Garabedian, D. Korn, and A. Jameson,
Courant Institute of Mathematical
Sciences, New York University

1975. v, 296p. paper \$12.10

Contents

Theory: Introduction. Models of Shock Structure. Iterative Schemes for Three Dimensional Analysis. Choice of Coordinates and Conformal Mapping. Two Dimensional Analysis with a Turbulent Boundary Layer Correction. Design in the Hodograph Plane—A New Model of the Trailing Edge. Design in the Hodograph Plane—Choice of Parameters. **Data:** Catalog of Transonic Airfoils. Evaluation of Analysis Methods. Comparison of Experimental Data with the Boundary Layer Correction. Comparison of Experimental Data with the Boundary Layer Correction Using the Quasiconservation Option. Drag Polars. Schlieren Photographs. **Fortran Programs:** Operation of the Turbulent Boundary Layer Correction Program H. Glossaries and Tables for Program H. Operation of the Three Dimensional Analysis Program J. Glossary and Table for Program J. Listing of the Boundary Layer Analysis Program H. Listing of the Three Dimensional Analysis Program J. Listing of Quasiconservation Option for Program H. Listing of Update for Design Programs B and D.

Volume 115

Foundations of Systems Theory: Finitary and Infinitary Conditions

By

B. D. O. Anderson, University
of Newcastle, New South Wales,
Australia, and **M. A. Arbib** and
E. G. Manes, University of
Massachusetts, Amherst

1976. vii, 93p. paper \$7.40

Contents

A General Setting for Discrete Action Nonlinear Systems. Nerode Equivalence Approach. Tree Automata: Finite Successes and Infinite Failures. Finite Step Conditions. Augmenting the Process.

Volume 123

Multiple Criteria Decision Making Proceedings of the XXII International Meeting of TIMS Held in Kyoto, Japan, July 24-26, 1975

Edited by

M. Zeleny, Columbia University,
New York

1976. xxvii, 345p. paper \$13.20

Contents

Guided Soul-Searching for Multi-Criterion Decisions. Interpersonal Comparison of Utilities. Group Decision Analysis. Externalizing the Parameters of Quasirational Thought. Multivariate Selection of Students in a Racist Society: A Systematically Unfair Approach. A Multi-Objective Model for Planning Equal Employment Opportunities. Experiences in Multiobjective Management Processes. The Theory of the Displaced Ideal. The Surrogate Worth Trade-Off Method with Multiple Decision-Makers. An Interactive Multiple Objective Decision-Making Aid using Nonlinear Goal Programming. Appli-

cations of Multiple Objectives to Water Resources Problems. On the Approximation of Solutions to Multiple Criteria Decision Making Problems. Why Multi-criteria Decision Aid may not Fit in with the Assessment of a Unique Criterion. Multiattribute Preference Functions of University Administrators. MCDM Bibliography—1975. Multi-criteria Simplex Method: A Fortran Routine.

Volume 124

The Computation of Fixed Points and Applications

By

M. J. Todd, Cornell University,
Ithaca, New York

1976. vii, 129p. paper \$7.40

Contents

Brouwer's Theorem. Some Applications of Brouwer's Theorem. Triangulations. Algorithms to Find Completely-Labelled Simplices. Extensions of Brouwer's Theorem. Applications of Kakutani's Theorem and its Extensions. Eaves' First Algorithm. Merrill's Algorithm. Homotopy Algorithms. Triangulations with Continuous Refinement of Grid Size. Measures of Efficiency for Triangulations.

Volume 128

Integer Programming and Related Areas

A Classified Bibliography

Compiled at the Institut für Ökonometrie und Operations Research, University of Bonn

Edited by
C. Kastning, University of Bonn,
Federal Republic of Germany

1976. xii, 495p. paper \$15.20

Contents

Preface. Introductory Remarks.
Subject List. Alphabetical Bibliography. Subject Classification.
List of Authors.

Volume 130

Multiple Criteria Decision Making

Proceedings of
a Conference

Held at Jouy-en-Josas,
France, May 21-23, 1975

Jointly sponsored by:
Centre d'Enseignement Supérieur
des Affaires (C.E.S.A.) and
European Institute for Advanced
Studies in Management
(E.I.A.S.M.)

Edited by
H. Thiriez, Chamber of Commerce
and Industry of Paris, and
S. Zionts, State University of
New York at Buffalo

1976. vi, 409p. paper \$14.40

Contents

From Optimisation to Multi-Criteria Decision Aid: Three Main Operational Attitudes. An Algorithm for Combined Quadratic and Multiobjective Programming. Quasi-Kernels of Outrank-

ing Relations. Existence and Duality in Multiple Objective Linear Programming. On the Relationship of the Tchebycheff Norm and the Efficient Frontier of Multiple-Criteria Objectives. Large Group Decision Making with Multiple Criteria. Multi-Person Multi-Criteria Decision-Making: A Sample Approach. Theoretical Analysis and Empirical Application of Goal Programming with Preemptive Priority Structures. R&D Project Selection Behavior: Study Designs and some Pilot Results. An Interactive Objective Function Generator for Goal Programmes. A Five Phase Procedure for Implementing a Vector-Maximum Algorithm for Multiple Objective Linear Programming Problems. Multiple Criteria Public Investment Decision Making by Mixed Integer Programming. A Comparative Study of Four Multiple-Criteria Methods. Multiple-Criteria Decision Making with a Special Application on Defense Problems. Multi-Level Planning in the Public Sector. Rational Solution Principles and Information Requirements as Elements of a Theory of Multiple Criteria Decision Making. Pareto Optimality with Nondifferentiable Cost Functions. The Notion of Characteristic Set and Its Implication for the Analysis and Development of Multicriterion Methods. Two-Level Planning with Conflicting Goals. Possibilities to Consider Multiple Criteria in Decision Situations. Quantifying Corporate Preferences for Policy Analysis. A Series-Parallel Multiple-Criteria Model for a Scheduling Problem in the Dress-Making Industry. Some Tests of an Interactive Programming Method for Multi-criterion Optimization and an Attempt at Implementation. A New Method for Interactive Multiobjective Optimization: A Boundary Point Ranking Method. A New Approach to Multiple Criteria Decision-Making. Selecting a Strategy for Joint

Ventures in Fisheries: A First Approximation. La Promotion de l'électricité dans l'industrie et l'utilisation de méthodes multicritères. Some Behavioural Aspects of Information Use in Decision Making: A Study of Clinical Judgements. A Behavioural Model of Company Development.

Volume 131

Mathematical Systems Theory

Proceedings of
the International Symposium
Udine, Italy, June 16-27,
1975

Edited by
G. Marchesini, University of
Padua, Italy, and
S. K. Mitter, Massachusetts
Institute of Technology,
Cambridge, Massachusetts

1976. x, 408p. paper \$14.40

Contents

Automata Theory. Linear Systems Theory. Bi-Linear and Non-Linear Systems. Infinite Dimensional Systems. Coding and Filtering for Sequential Systems. General Dynamical Systems and Categorical Approach to Systems.

5

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Volume 1

Deterministic and Stochastic Optimal Control

By
W. H. Fleming, Brown
University, Providence, Rhode
Island, and **R. W. Rishel**,
University of Kentucky,
Lexington, Kentucky

1975. ix, 222p. 4 illus.
cloth \$24.80

This is a concise introduction
both to standard topics in deter-
ministic optimal control theory
(Pontryagin's principle, existence
theorems, dynamic program-
ming) and to the stochastic opti-
mal control for Markov diffusion
processes, utilizing the relation-
ship between second order partial
differential equations of parabolic
type and stochastic differential
equations as well as dynamic
programming.

Contents

The Simplest Problem in Cal-
culus of Variations. The Optimal
Control Problem. Existence and
Continuity Properties of Optimal
Controls. Dynamic Program-
ming. Stochastic Differential
Equations and Markov Diffusion
Processes. Optimal Control of
Markov Diffusion Processes.

Volume 2

Methods of Numerical Mathematics

By
G. I. Marchuk, Computer
Center, Novosibirsk, USSR

Translated from the Russian by
J. Ružička

1975. xii, 316p. 10 illus.
cloth \$29.80

Continued

This book originates from lectures in applied and numerical mathematics, in which complicated mathematical problems occurring in physics, engineering economics, systems sciences, etc. were discussed with and made accessible to scientists whose primary interest was not in mathematics. The book is also of great help to anyone who is interested in the application of modern mathematical methods to his field of specialization.

Contents

Fundamentals of the Theory of Difference Schemes. Methods of Constructing Difference Schemes for Differential Equations. Methods of Solving Stationary Problems of Mathematical Physics. Methods for Solving Non-Stationary Problems. Numerical Methods for Some Inverse Problems. The Simplest Problems of Mathematical Physics. Numerical Mathematics in the Theory of Radiative Transfer. A Review of the Methods of Numerical Mathematics.

Volume 3

Applied Functional Analysis

By

A. V. Balakrishnan, University of California, Los Angeles

1976. x, 309p. cloth \$19.80

This introduction to applied functional analysis emphasizes topics like Volterra and Hilbert-Schmidt operators, semigroup theory in Hilbert spaces, boundary-value problems, and questions of controllability and observability. The style is informal but still precise, with special attention given to carefully worked-out applications and problems.

Contents

Basic Properties of Hilbert Spaces. Convex Sets and Convex Programming. Functions, Transformations Operators. Semigroups of Linear Operators. Optimal Control Theory. Probability Measures on a Hilbert Space.

Volume 4

Stochastic Processes in Queueing Theory

By

A. A. Borovkov, Academy of Sciences of the USSR, Novosibirsk, USSR

Translated from the Russian by **K. Wickwire**

1976. xi, 280p. 14 figs. cloth \$29.80

This is a presentation of modern queueing theory from a unifying structural viewpoint. The basic approach here is to study the transient or limiting behavior of queueing systems via algorithms on which the corresponding sequences of arrival and service times depend. Since all members of a class of system are governed by the same algorithms, seemingly disparate results can be seen to follow from the same property of a general algorithm. This English translation of a Russian book, published in 1972, contains nearly 100 pages of additional material, including several detailed numerical examples, prepared by the author.

Contents

Systems with Queues and Service of Type One. Some Boundary Problems for Processes Continuous from below with Independent Increments. Their Connection with the Distribution of $w(t)$. Boundary Problems for Sequences with Independent Increments and Factorization Identities. Properties of the Supremum of Sums of Independent Random Variables and Related Problems of Queueing Theory. Multi-Channel Queueing Systems. The Systems $\langle G, G, G/\infty, 1 \rangle$ with an Infinite Number of Service Channels. Systems with Refusals. Systems with Autonomous Service.

Section



A selection from Applied Mathematical Sciences

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G. B. Whitham, California Institute of Technology/Firestone Laboratory, Pasadena, California

Volume 10

Numerical Quadrature and Solution of Ordinary Differential Equations

A Textbook for a Beginning Course in Numerical Analysis

By

A. H. Stroud, Texas A&M University

1974. xii, 352p. 15 illus. paper \$9.50

This is a textbook for half of a two semester introductory course on numerical analysis. It covers polynomial interpolation, numerical quadrature and numerical solution of initial value problems for ordinary differential equations. The book constitutes an interesting and well-written introduction to its field covering its topics more extensively and in more detail than most other textbooks.

Contents

Background Information. Interpolation. Quadrature. Initial

Value Problems for Ordinary Differential Equations.

Volume 15

Differential Equations and Their Applications

An Introduction to Applied Mathematics

By

M. Braun, Brown University, Providence, Rhode Island

1975. xiv, 718p. 59 figs. paper \$14.80

This is a clearly written rigorous study of differential equations with an abundance of fascinating and carefully worked-out examples such as diabetes, the Threshold Theorem of Epidemics, the Tacoma bridge disaster, art forgeries, and Darwin's Laws. Also included are an introduction to APL and examples of how to use the computer for the solution of quantitative problems.

Contents

First Order Differential Equations. Second Order Linear Differ-

Continued

ential Equations. Systems of First Order Equations. Qualitative Theory of Differential Equations. Separation of Variables and Fourier Series.

Volume 18

Pattern Synthesis

Lectures in Pattern Recognition
Volume 1

By
U. Grenander, Brown University,
Providence, Rhode Island

1976. vii, 509p. 112 illus.
paper \$14.80

This book is devoted to a mathematical study of regular structures intended as a theoretical basis for analyzing patterns in general. These patterns are not restricted to any particular type; they can be geometric, temporal, behavioral, etc. The object of the book is not traditional pattern recognition, but rather the development of a precise formalism which can serve as the conceptual basis for synthesizing (the subject of this volume) and analyzing (subject of a subsequent volume) patterns, as well as helping us to understand how they are formed and processed. The concrete subject of pattern synthesis is the formation of patterns by combination, identification, and deformation. The most important tools are direct mathematical analysis and computational experiments (done in APL and with the aid of various computer graphics devices).

Contents

The Generators. The Configurations. The Images. The Deformations.

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A list of selected volumes from CISM— International Centre for Mechanical Sciences

No. 18

Selected Topics in Information Theory

By
G. Longo, University of Trieste
1973. 111p. 4 illus. paper \$9.00

No. 84

Stochastic Processes with Learning Properties

By
S. Csibi, Technical University of
Budapest

1975. 151p. paper \$11.10

No. 114

Linear Adaptive Decision Functions and Their Application to Clinical Decision

By
A. Vesely, Medical Cybernetics
Research Group Uhkt, Prague,
and **I. Vajda**, Czechoslovak
Academy of Sciences, Prague

1971. 45p. 2 illus. paper \$5.00

No. 155

Computer Aided Automatic Design

By
C. Bona, Olivetti, Ivera, and
C. Galletti and **A. Lucifredi**,
University of Genoa

1974. 35p. 41 illus. paper \$3.90

No. 166

Advances in Source Coding

By
T. Berger, Cornell University,
Ithaca, New York, and
L. D. Davisson, University of
Southern California

1975. 71p. 6 illus. paper \$6.20

No. 188

A Short Course on Error Correcting Codes

By
N. J. A. Sloane, Bell
Laboratories, New Jersey

1975. 76p. 6 illus. paper \$6.00

Design Methods for Digital Systems

By

J. Chinal, Ecole Nationale Supérieure de l'Aéronautique et de l'Espace, Toulouse, France

Translated from the French by
A. Preston and A. Sumner

1973. xvii, 506p. 310 figures & tables. cloth \$38.10

"This is basically a switching theory book with some examples of simple digital circuits. An impressive amount of material is included in the 16 chapters, ranging from number systems and codes, through Boolean algebra, minimization techniques, and regular expressions, to digital counters. The style is concise, clear, even elegant. On the basis of its coverage and the clarity of the presentation, the book should be valuable to the reader with some background in switching theory and an interest in combinatorial and sequential circuit design and minimization."

Computing Reviews

Contents

General Concepts. Numeration Systems — Binary Numeration. Codes. Algebra of Contacts. Algebra of Classes — Algebra of Logic. Boolean Algebra. Boolean Functions. Geometric Representations of Boolean Functions. Applications and Examples. The Simplification of Combinational Networks. Concept of the Sequential Network. Sequential Networks — Definitions and Representations. Regular Expressions and Regular Events. The Simplification of Sequential

Networks and Minimization of Transition Tables. The Synthesis of Synchronous Sequential Networks. Counters.

PASCAL — User Manual and Report

Corrected Reprint of the
Second Edition

By

K. Jensen and N. Wirth, Institute for Computer Science, ETH Zurich, Switzerland

Springer Study Edition
1976. viii, 167p. paper \$5.90

PASCAL is a programming language which has been developed with the idea of systematic programming in mind; it is particularly suited for structure programming and non-numerical applications and is distinguished by its organization of data structures, small number of basic concepts, and efficient implementation. This volume contains a revised report and a user manual which is intended for those who have previously acquired some programming skill and provides a means of learning PASCAL without outside guidance.

Contents

User Manual: Notation and Vocabulary. The Concept of Data. The Program Heading and the Declaration Part. The Concept of Action. Scalar and Sub-range Types. Structured Types in General — The Array in Particular. Record Types. Set Types. File Types. Pointer Types. Procedures and Functions. Input and Output. PASCAL 6000-3.4. How to Use the PASCAL 6000-

3.4 System. **Report:** Introduction. Summary of the Language. Notation, Terminology, and Vocabulary. Identifiers, Numbers and Strings. Constant Definitions. Data Type Definitions. Declarations and Denotations of Variables. Expressions. Statements. Procedure Declarations. Function Declarations. Input and Output. Programs. A Standard for Implementation and Program Interchange.

Calculus with Applications and Computing

Volume 1

By

P. Lax, S. Burstein, and A. Lax, Courant Institute of Mathematical Sciences, New York University

Undergraduate Texts in
Mathematics
Editors

F. W. Gehring and
P. R. Halmos

1976. xi, 513p. 170 figs.
cloth \$14.80

The central notion of this new calculus text is the relation of calculus to science. This expresses itself in many examples and the important role which is given to numerical examples which appear in this book as a genuine part of the presentation. Many theoretical and practical exercises are included.

Contents

Real Numbers. Functions. Differentiation. Integration. Growth and Decay. Probability and Its Applications. Rotation and the Trigonometric Functions. Vibrations. Population Dynamics and Chemical Reactions. FORTRAN Programs and Instructions for Their Use.

Revised Report on the Algorithmic Language ALGOL 68

Edited by

A. Van Wijngaarden, B.J. Mailloux, J.E.L. Peck, C.H.A. Koster, M. Sintzoff, C.H. Lindsey, L.G.L.T. Meertens, and R.G. Fisker

1976. ii, 236p. paper \$9.90

Approved for publication by the General Assembly of the International Federation for Information Processing, this revised edition of the *Report on the Algorithmic Language—ALGOL 68* is designed to communicate algorithms, to execute them effectively on a variety of different computers, and to aid in teaching them to students.

Contents

Acknowledgements: Introduction. **Preliminary Definitions:** Language and Metalanguage. The Computer and the Program. **Fundamental Constructions:** Clauses. Declarations, Declarers, and Indicators. Units. **Context Dependence:** Coercion. Modes and Nests. **Elaboration-Independent Constructions:** Denotations. Tokens and Symbols. **Environment and Examples:** Standard Environment. Examples. Glossaries.

Software Engineering Education

Needs and Objectives

Edited by **A. I. Wasserman**, University of California, San Francisco and **P. Freeman**, University of California, Irvine

Proceedings of an Interface Workshop

1976. viii, 159p. 19 illus. paper \$9.80

The need for quality education in software engineering is recog-

Continued

nized by practitioners and educators alike. As a result, a one-day "Interface Workshop on Software Engineering Education: Needs and Objectives" was organized to bring together practitioners of software engineering and educators working to build quality curricula in software engineering. Approximately 40 specialists, representing industry, government, and universities attended the meeting. This book contains the questions, ideas, opinions, and conclusions of the Workshop.

Contents

Introduction: Software Engineering Education: Workshop Overview. Software—The Next Five Years. **Industry Needs for Software Engineering Education:** Software Engineering Education: Some Industry Needs. Software Engineering: The Commercial Data Processor's Needs. The Software Engineer: Role, Responsibilities, and Education. What the Software Engineer Should Know about Program Verification. Responsibilities of the Software Engineer in the Reliability Area. Should We Seek a Problem-Oriented Specialization? Software Engineering: An Art Searching for Scientific Recognition? On the Need for Teaching First Principles in Software Engineering. **University Plans and Programs in Software Engineering Education:** On the Skills Required for Software En-

gineering. Software Engineering as a Central Computer Science Discipline. The Software Project as a Serious Game. Realism, Style, and Design: Packing It into a Constrained Course. An Experimental Project Course in Software Engineering. Making Software Engineering Issues Real to Undergraduates. Toward Improved Software Engineering Education. The Central Role of Design in Software Engineering. Performance Analysis as a Fundamental Objective in Software Engineering Education. A Bachelor of Arts in Computer Programming. **Discussion Topics:** University-Industry Cooperation. Faculty Sabbaticals in Industry. Industrial Education. Design Training. Where Should Various Topics Be Learned? Where Do We Go from Here? **Conclusion:** Postscript. A Highly-Selective, Annotated Software Engineering Bibliography

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Acta Informatica

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Subscription information

Volume 6 (4 issues) 1976
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Applied Mathematics and Optimization

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Edited by
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Mathematical Systems Theory

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A. L. Rosenberg, G. P. Szegő

Mathematical Systems Theory

features contributions to the
theories of both discrete and con-
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concepts of systems, with moti-
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in engineering and computer sci-
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